OBSTETRIC ANAL SPHINCTER INJURY: RETROSPECTIVE REVIEW OF RISK FACTORS

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Dr. Zahar Azuar Zakaria

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ABBREVIATIONS

ADJ	=	Adjusted
HUSM	=	Hospital Universiti Sains Malaysia
KG	=	Kilogram
MMR	=	Maternal mortality rate
MOD	=	Mode of delivery
OASI	=	Obstetric anal sphincter injury
OR	=	Odds ratio
PNMR	=	Perinatal mortality rate
SVD	=	Spontaneous vaginal delivery
USM	=	Universiti Sains Malaysia
USMCK	=	Universiti Sains Malaysia Cawangan Kelantan
GNP	=	Gross National Product
GDP	=	Gross Domestic Product
ICU	=	Intensive Care Unit
ECG	=	Electrocardiography

CONTENTS

AIMS OF THE STUDY

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1. To study the epidemiological aspect of obstetric anal sphincter injury (OASI).
2. To identify the associated risk factors of obstetric anal sphincter injury.

ABSTRACTS

ABSTRAK

Objektif: Mengenal pasti epidemiologi dan faktor yang berkaitan dengan kecederaan obstetrik sfinkter anus yang berlaku semasa kelahiran melalui vagina.

Kaedah: Kajian retrospektif selama 5 tahun ke atas 52 pesakit yang mengalami kecederaan obstetrik sfinkter anus di Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan bermula dari Januari 1996 sehingga Disember 2000. Kontrol adalah tiga kelahiran sebelum dan selepas kelahiran indeks. Analisis regresi logistik digunakan untuk menguji faktor risiko.

Keputusan: Terdapat 52 pesakit yang mengalami kecederaan obstetrik sfinkter anus selepas kelahiran vagina di antara 32,831 kelahiran melalui faraj yang cukup bulan, menggambarkan insidens sebanyak 0.16%.

Tiada perbezaan yang jelas dari segi umur ibu dan tempoh masa mengandung semasa kelahiran. Perkaitan juga tidak dilihat dari segi sejarah kelahiran menggunakan peralatan obstetric pada masa yang lalu, presentasi fetus, penggunaan episiotomi, penggunaan oksitosin atau penggunaan ubat penahan sakit (Pethidine dan kaedah epidural) semasa proses kelahiran.

Analisis univariat menunjukkan kecederaan obstetrik sfinkter anus adalah berkaitan dengan nulipara, kelahiran instrumentasi (forseps dan vakum), peringkat kedua kelahiran yang panjang, berat lahir bayi melebihi 4 kg dan di kalangan kaum Cina. Analyis logistik regresi berperingkat untuk mengawal faktor-faktor berkaitan menunjukkan perkaitan yang ketara pada berat kelahiran bayi melebihi 4 kg dan kaum Cina.

Kesimpulan: Faktor-faktor yang mempengaruhi kejadian kecederaan obstetrik sfinkter anus boleh dikenalpasti tetapi bukan semua boleh dimanipulasi oleh pakar perbidanan. Memandangkan komplikasi kecederaan ini sukar dirawat, langkah untuk mengelakkan faktor kejadian patut menjadi keutamaan.

ABSTRACT

Objective: To identify the epidemiology and risk factors associated with obstetric anal sphincter injury during vaginal delivery.

Methodology: A five years retrospective review of 52 patients who sustained obstetric anal sphincter injury during vaginal delivery in Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan between January 1996 to December 2000. The control was the three singleton vaginal deliveries prior to and following the index delivery. Logistic regression analysis was used to assess risk factors.

Results: There were 52 patients who had obstetric anal sphincter injury after vaginal delivery amongst 32,831 singleton vaginal deliveries at term, giving an incidence of 0.16%.

There was no significant difference in maternal age and gestational age at delivery time. No association was seen in term of past history of instrumental delivery, presentation of the fetus, the use of mediolateral episiotomy, oxytocin augmentation of labour or the use of analgesia (intramuscular Pethidine and epidural analgesia) during labour.

Univariate analysis showed the OASI was associated with nulliparity, instrumental delivery (both forceps and vacuum extraction), prolonged second stage of labour, birth weight of more than 4 kg and Chinese ethnic group. Previous vaginal delivery was shown to be a protective factor against OASI. Stepwise logistic regression analysis to control the possible confounding factors later revealed statistically significant risk factors for OASI are Chinese race group and the birth weight of more than 4 kg.

Conclusion: Associated risk factors of obstetric anal sphincter injury can be identified but not all are applicable to obstetrician manipulation. As complications of this condition are difficult to manage, avoidance of the known risk factors should be prioritised.

THE STATE OF KELANTAN AND KELANTAN HEALTH SERVICES

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Kelantan, which mean "Land of Lightning', is characterized by a more relaxed and traditional way of life than many other states in Malaysia. It is located in the northeast part of Peninsular Malaysia. Sixty two percent of its total area of 15,000 sq. km is still covered with forest particularly to the south. The state capital, Kota Bharu is located at the bank of Kelantan River and situated 627 kilometres from the Federal Capital, Kuala Lumpur. Kota Bharu, Pasir Mas, Tanah Merah, Tumpat, Bachok Pasir Puteh, Jeli, Kuala Kerai and Gua Musang made up ten administrative districts of Kelantan with a total population of 1.4 millions. Ninety three percent of the population are Malays, while the Chinese, Indian and Siamese descendent make up the other 7%.

Kelantan has been a centre of human activity and settlement since prehistoric times, and has existed as a political entity for over a thousand years. Important prehistoric remains of the Stones Age men have been found at Gua Cha (The Cha Caves), Gua Musang and at other sites of the interior. Kelantan was probably a vassal of Sri Vijaya.

When Islam came to the Malay world, Kelantan became one of the earliest Muslim states in the region. This was based on the finding of a gold coin at Kubang Labu

which on one side was written in Arabic ' Al – Julus Kelantan ' (seat of Kelantan Government) and on the other, the date 577 Hijrah (about 1180 A.D).

Kelantan had enjoyed a long period of autonomy after the fall of Malacca but nevertheless affected by the relentless pressure of Thailand on the state of Kedah and Pattani. By the beginning of the 19th Century, the state was the most populous in the Peninsular but the Thais and the Malays of neighbouring state, Terengganu, dominated its politics.

Despite a resurgence of autonomy in the middle of the century, by 1900 Kelantan was recognised as a tributary state of Thailand. In 1909, as a result of a treaty signed by Thailand and Britain, the British assumed over the lordship of Kelantan and a British Advisor was appointed in Kota Bharu.

Kota Bharu was the site of the first landing by the Japanese troops in 1941 during the World War II. As a result of Japanese rule, Kelantan was again placed under Thailand during period of war. Kelantan eventually became a part of the Federation of Malaya in 1948.

In Kelantan, tourism has excellent potential. Its rich cultural heritage/tradition and beaches makes it one of the most interesting and unique places for a vacation. Most

of the long stretches of clean; sparkling unspoiled beaches and islands are found here. The water is clear with magnificent coral, which makes it heaven for tourists who throng to enjoy in swimming, snorkelling and scuba diving. Meanwhile the favourite pastime of the Kelantenese includes kite flying (wau), top spinning (gasing), drum beating (rebana), bird singing (merbok) competitions and shadow plays (wayang kulit). Handicraft such as superb hand printed cloth (batik), cloth woven with silver and gold threat (songket), intricate woodcarvings and exquisite silverware, crafted with much skill and imagination that it pays a tribute to the strong culture of this state. In recent years, the Kelantan cottage industries have become increasingly successful with traditional crafts producing batik cloth, kain songket (fine embroideries), ornate silverware and colourful tops and kites.

Nevertheless agriculture forms the backbone of the state's economy. It was estimated to account to 22.7% share of the GNP in 1993. Total area used in that year was about 369,936 hectares or 24% of the total land area in the state. Rubber and paddy were the main crops and accounted for 65% of the total agriculture areas. The major paddy areas fall under the Kemubu Agriculture Development Authority (KADA) that accounts for 72% of the total production. Rubber production occupied a total land area of 156,136 hectares of which more than half were under smallholdings and the rest were under large plantations. An estimated 55,000 people were employed at these plantations with the average acreage of trees being 16 years or more.

Tobacco is an upcoming crop now in the state and is the producer of more than 90% of it in Malaysia. Other important agricultural crops are coconut, cocoa, corn and vegetables, which are cultivated in smaller scales but is quickly picking up in the market.

Forestry with the total acreage of 894,516 hectares is the rich timber resource of the state. Though not fully developed the main variety if timber is of the valuable tropical hardwood of the dipthercarp species. Only log production is within the state as bulk timber is processed outside the state. The government encourages logs to be fully processed within the state. Thus there are opportunities for employment not only for the primary products but also 'waste' from primary processing.

Livestock/fishery production is also an important sub sector of the agriculture economy. Apart from agriculture, Kelantan is also rich in deposits of gold, barite and manganese. Other minerals such as zincs, copper and lead have been found and the exploration for various base metals are being actively pursued. Vast deposits such sand, industrial clay and limestone has been earthen. Industries based on these are encouraged, as there are good potential for success.

High priority areas now are industry and manufacturing. In 1993, is has been noted that RM 282.1 million was contributed to the GNP of Kelantan. Thus the government has given emphasis to this sector in order to create more employment opportunities.

At the same time, to serve as a catalyst to growth and boost development within the state. One of the major tools for promoting development in Kelantan is the industrial estate. The year 1974 saw the opening of the first industrial estate in Pengkalan Chepa with the site of 9.7 hectares. Other estates were subsequently opened and their location was selected based on the natural resources and commercial centres nearby. The Kelantan State Economic Development Corporation (KSEDC), which operates within the state's planning system, manages development of these industrial estates. KSEDC is responsible for the provision of infrastructure monitors progress of work and contributes towards the formulation of policy at the state level. Currently, Kelantan has seven industrial estates for medium and light industries.

People are the major resource of Kelantan. Due to the skill, diligence and assiduity they have gained an excellent reputation throughout the region. In 1990, the total manpower was around 767,700 of which 392,495 constituted an active workforce. In the past, migration was high, as many Kelantanese had been working in the West Coast of the Peninsular. This particular group forms a pool of skilled labour workforce that could be attracted back with appropriate measures for the industrialization of the state. Basic wage rate is comparatively lower than in other parts of the country. This indirectly attributes to the large population of the state belonging to the low socio-economic group.

Kelantan's gross economic product has grown steadily. The GDP grew from RM 1,463 million in 1985 to RM 2,485 million in 1993. This spectacular growth can be attributed to proper planning and commitment from both the public and the private sectors. Key economic areas have been thus identified and expanded with proper administration and supervision. The per capita income has also registered a steady increase from RM 2,081. The growth of the economic sector has been encouraging, as it has been comparatively high and the rapid diversification of the economy points to an above average growth rate. The economic growth rate for 1994- 1995 is estimated at 6.4 percent.

The birth rate was 42.55 births per 1000 population in 1992 with the population growth rate of 2.6% per year. Over the past 10 years, the state medical and health services have improved tremendously with the opening of district hospitals and health centres along with a substantial social, educational and economic development.

In addition to that, to cater for Kelantan's health care, there are two tertiary referral centres, the Hospital Kota Bharu and Hospital Universiti Sains Malaysia (HUSM). The Kota Bharu Hospital is located in the state capital and is one of the oldest hospital in Malaysia. It was built in 1930 and was the only referral centre for the state until 1984 when the new Hospital Universiti Sains Malaysia started to function.

The percentage of the hospital delivery was 60% in 1992 as compared to only 30% in 1982. Maternal mortality rate was 51.8 per 100,000 births. Perinatal mortality rate and infant mortality rate dropped markedly from 22.3/1000 live births and 20.3/1000 live births in 1984 to 14.6/1000 and 12.9/1000 in 1992 respectively.

The medical and health services are provided by eight hospitals, one in each district except Bachok and Jeli and 48 health community clinics and midwife centres.

THE SCHOOL OF MEDICAL SCIENCES AND HOSPITAL UNIVERSITI SAINS MALAYSIA

THE SCHOOL OF MEDICAL SCIENCES AND HOSPITAL UNIVERSITI SAINS MALAYSIA (HUSM)

Universiti Sains Malaysia (USM) , the second university in Malaysia was established in 1969 in Pulau Pinang. Subsequently two branch campuses were built in Kelantan and Perak in 1983 and 1985 respectively. USM Perak Branch houses the various schools of engineering while Kelantan Branch, to date has its School of Medical Sciences (SMS) and a teaching hospital, Hospital Universiti Sains Malaysia (HUSM).

From the very beginning and true to its name, USM is given mandate to provide, promote and develop higher education in fields of Natural Sciences, Applied Sciences, Pharmaceutical Sciences, Building Sciences and Technology, Social Science, Humanities and Education. Emphasis is given to research and advancement of knowledge and dissemination of such knowledge in these fields of study. The University has not departed from these terms of reference and is proud of its innovative approach in tertiary education.

The USM Kelantan campus started to develop in 1983 when the Ministry of Health Malaysia handed over a newly completed hospital building to USM to act as a teaching hospital for its medical undergraduates. Then the campus only accommodated the 4^{th} and 5^{th} year medical students and academic staffs from the

clinical disciplines. First, second and third year students remained at the main campus in Penang together with their lecturers and administrative machinery of the school. The Medical Complex, the sport complex and the animal house were built under Phase 1 Project. This project was completed in April 1990 and in June the same year the whole School of Medical Sciences moved from the main campus to the sub campus. This move marked the beginning of the administrative machinery of Universiti Sains Malaysia Cawangan Kelantan (USMCK).

USMCK is situated on 72.84 hectares of flatland in the suburbs of Kelantan's state capital Kota Bharu, at Kubang Kerian township, has the potential to expand and develop. The presence of USMCK in Kubang Kerian has activated commercial and housing development. This once quiet suburb of Kota Bharu is planned to be the satellite town in near future.

A Director whose authority is handed down from the Vice Chancellor is the administrator of this campus. The Director is responsible to coordinate all administrative and academic matters to ensure the smooth running of the campus. To assist him in these administrative and managerial functions, supporting departments at the main campus have set up their branches here. In the day-to-day operations, these branch departments are directly answerable to the Director while adhering to policies set by the headquarters. Since the inceptions of this campus, the various

branch developments set up are the Registry, Bursary, Development (Engineering), Security, Medical Library, Computer Centre Branch, Language Unit and Students' Affair Division.

The people in the street know HUSM better than any other components if this campus. This may be due to the facts that the hospital building was the first landmark of the campus because of its direct involvement with community. HUSM is headed by a Director and assisted by two Deputy Directors. The various heads of departments and heads of units also assist him.

The Hospital Universiti Sains Malaysia (HUSM) is the teaching hospital for the School of Medical Sciences, Universiti Sains Malaysia. It was built in 1976 under the Third Malaysian Plan. The construction was completed in 1984 and was officially opened by His Royal Highness Al-Sultan Kelantan on 26th of August 1984. The first patient was admitted on 21st January 1984 and the first baby was born in April 1984.

Besides teaching and research, the University Hospital also provides adequate medical services for the community. With the presences of specialists and consultants in various fields of medical and related disciplines, is also serves as the referral centre for the state and the neighbouring states in the East Coast of Peninsular Malaysia.

Services offered by HUSM can be categorized into two, namely the Out-patient Service and the In-patient Service. Out-patient Service consists of:

1) Community Medicine Clinic that is opened on all working days from 8.30 am to 4.30 pm.

2) Specialist Clinics that are opened from Saturday to Wednesday and accept cases by referral and appointment.

3) Accident and Emergency Unit that is opened for 24 hours a day to attend all kind of urgent cases.

In-patient Service provides treatment in one of the 28 available wards in HUSM. The wards are divided into various disciplines such as Obstetrics and Gynaecology, Surgery, Orthopaedic, Psychiatry, Ophthalmology, Otorhinolaryngology, Paediatric, Medical, Oncology, Intensive Care Unit, Coronary Care Unit and Neonatal ICU. The hospital has a total of 675 beds for all disciplines. At the moment, a new five stories building meant for Dental School is in development.

All departments are adequately staffed and the hospital has support services from the Radiology Department, Nuclear Medicine Unit and laboratories. The Blood Bank supplies blood and blood products as well as other haematological tests and screening. The Physiotherapy Unit and the Haemodialysis Unit provide the necessary therapies. The Dietetic Unit prepares food for all in-patients and does diet counselling for the patients needing diet manipulation. The Laundry Unit ensures constant supply

of linen to the wards while the Housekeeping Unit is responsible to the cleanliness of general areas in the hospital.

THE DEPARTMENT OF

OBSTETRICS AND GYNAECOLOGY

THE DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

In year 2000, the Department of Obstetric and Gynaecology is staffed by eleven consultants/lecturers, six registrars (final year master students), fourteen medical officers (with another fifteen posted in other state general hospitals as in the long distance learning program) and twelve house officers. The postgraduate program was started in 1991 and the first Master of Medicine candidate in Obstetrics and Gynaecology graduated in June 1995.

The department of Obstetrics and Gynaecology occupies the first and second floor of the new hospital building, above the Obstetrics and Gynaecology clinic. There are two gynaecology wards in the first floor of the main hospital building, with the total of 62 beds, two antenatal wards (Akek and Baiduri) and one postnatal (Topaz) ward in the second floor with the total of 80 beds (40 antenatal beds and 40 postnatal beds).

The labour ward is situated on the first floor of the same building. It is equipped with ten two bedded delivery rooms, in which two beds are in the admission room, four beds are for pre-eclampsia cases or those requiring intensive care managements, two beds for infectious diseased cases, two for premature labour cases and eight beds for low risk deliveries. There is no special induction rooms, and the patients are induced either in the obstetrics wards or in the labour room (high risk patients).

The labour ward is equipped with two ultrasonography machines, five cardiotocography (CTG) machines, ECG monitoring machines, infusion pumps, two resuscitation trolleys, blood warmers, central vacuum and oxygen supply.

Within the labour ward, a room is specially equipped for neonatal resuscitation, complete with neonatal resuscitation trolley, warmers and incubators. The Neonatal Intensive Care Unit (NICU) is housed adjacent to the labour ward and is equipped with the facilities for the care of the complicated newborns.

There is an operation theatre in the labour ward, which is opened during office hours for emergency obstetrics procedures such as caesarean sections and manual removal of placenta. There is an anaesthetic medical officer rostered to the labour ward during the office hours to provide epidural analgesia service and anaesthesia for emergency obstetric procedures.

The total number of deliveries, modes of delivery, perinatal and maternal mortality rate for HUSM from 1996 to 2000 were:

Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Total Deliveries	8804	7669	7712	6930	7778	7487
Mode of Deliveries						
1) SVD	80.1	79.3	79.3	81.1	82.6	82.7
2) Vacuum	2.9	3.4	2.9	2.2	2.4	1.2
3) Forceps	1.2	1.5	1.8	1.1	1.0	1.1
4) C-Section	11.3	10.7	12.4	13.6	11.8	11.6
5) Breech	2.7	2.8	2.6	2.1	2.0	2.4
6) Twin	1.0	1.0	1.0	0.9	1.2	1.0
Still Birth (per 1000)	13.3	14.5	13.0	15.2	11.6	10.6
PMR (per 1000)	19.1	23.1	21.9	23.9		
MMR (per 1000)	35.16	52.2	12.96			

The obstetrics and gynaecology clinic are situated at the ground floor of the same building, and is equipped with two ultrasonography machines, a cardiotocography machine and a colposcope. The clinic schedules are:

DAY	MORNING	AFTERNOON
Saturday	Antenatal Booking Clinic	Antenatal Booking Clinic
Sunday	Antenatal Outpatient Clinic	Gynaecology Outpatient Clinic
Monday	Menopause Clinic Combined Clinic	Molar and Oncology Clinic
Tuesday	Antenatal Outpatient Clinic	Gynaecology Outpatient Clinic
Wednesday	Fertility Augmentation Clinic	Postnatal and Family Planning Clinic

The doctors are divided equally into four teams to man these clinics as well as the wards and duties during normal working days as well as on call days. This system had been well accepted.

The number of outpatient seen from 1995 till 2000 were as follows:

YEAR	GYNAECOLOGY OUTPATIENT	OBSTETRIC OUTPATIENT
1995	4174	10296
1996	4725	10146
1997	5319	11741
1998	5666	11826
1999	6026	9854
2000	5945	9144

INTRODUCTION

INTRODUCTION

The state of pregnancy, although often a period of happy anticipation for many women, also can be a period of increased morbidity. One of the main reason for immediate and late postpartum morbidity is perineal trauma, suffered during vaginal delivery caused by either episiotomy or perineal tear.

Perineal tear were classified into various degree depending upon the extend of injury to the perineal structure. A first-degree perineal tear involved the fourchette, the perineal skin, vaginal epithelium but not the underlying fascia and muscles. A second-degree tear also involved the fascia, muscle, perineal body but not the anal sphincter. But there is lack of consistency in the definition of a perineal tear involving the anal sphincter. Donald (1979), defined a third degree tear as a perineal tear in which the sphincters and anal epithelium are involved, hence implying that involvement of the anal sphincter without a tear in the anal epithelium should be classified as second degree. Some consider involvement of the anal epithelium as less important (Myerscough 1982) while others classify a tear, which involves the anal sphincter and epithelium as fourth degree (Cunningham 1993, Sangalli 2000). Involvement of the anal mucosa may indicate a more extensive lesion, as the internal anal sphincter would invariably tear, but Sultan (1994) showed that the outcome of primary repair does not appear to be influenced by anal epithelium disruption, apart from the risk of residual ano-vaginal fistula. But in a recent study (Sangalli 2000), it was shown that anal incontinence was more common in women with 4^{th} than 3^{rd} degree tears. It was also noted that subsequent deliveries were associated with higher

prevalence of severe incontinence in those with fourth degree tears. For descriptive purposes when the anal epithelium is also involved it should be addressed as fourth degree tear.

Further classification has also been proposed by Tetzschner et al (1995), based on the following definition:

1. Superficial if less than one-third of the external sphincter were affected.
2. Partial rupture if more than one-third of the muscle was affected but not a complete tear of the external anal sphincter.
3. Complete rupture if the muscle endings were totally separated, with or without damage of the anal mucosa.

To avoid confusion and standardized the reporting concerning this issue, obstetric anal sphincter tear (OASI) was proposed by Fernando et al (2000) in place of more traditional of third degree perineal tear (if it involve external anal sphincter and sometimes internal anal sphincter) or as fourth degree perineal tear (if it involves anal sphincter and ano-rectal mucosa).

The reported incidence of clinically detectable OASI is in range of 0.4 – 3.7 % (Haadem 1987, Bek and Laurberg 1992, Sultan 1994, Walsh 199,; Gjessing 1998, Jander and Lyrenas 2001) but there are some reports of higher incidence reaching 6% (Zetterstorm 1999). By contrast, the reported incidence of occult or clinically unrecognised anal sphincter injury detected by anal endosonographic examination is about 35% in primiparous women and 44% in multiparous women (Sultan 1993).

Crawford et al (1993) reported a very high frequency of anal sphincter rupture (22%) in primiparous women who had a midline episiotomy compared with 4% for primiparous women without episiotomy. Even higher incidence (30%) is seen with instrumental deliveries (Combs 1990).

	Author	Incidence (%)	Year
1.	Sorensen	0.5	1988
2.	Tetzschner	0.7	1988
3.	Green	13	1989
4.	Kurakuracchi	5	1989
5.	Combs	30	1990
6.	Bek	0.41	1992
7.	Anthony	1.4	1994
8.	Walsh	0.56	1996
9.	Poen	1.8	1997
10.	Gjessing	0.8	1998
11.	Donelly	2	1998
12.	Wood	1.2	1998
13.	Peleg	19.3	1999
14.	Samuelsson	3.3	2000
15.	de Leeuw	1.94	2001
16.	Jander	3.7	2001
17.	Parnell	8.4	2001

Immediate postpartum complications of OASI are perineal pain, discomfort and infection (Haadem 1988). These acute symptoms may then interfere with the mother's ability to care for and breastfed her infant.

One of the most important long-term complications is anal incontinence (faecal incontinence, flatus incontinence, faecal urgency) with the reported incidence ranging from 7 to 59% (Bek 1992, Kamm 1994, Tetzscher 1996, Walsh 1996, Gjessing 1998).

The association between anal sphincter tear and subsequent anal incontinence have been shown in numerous studies. Other long term complications are chronic perineal pain and dyspareunia (painful intercourse) as reported to be around 29% (Gjessing 1998). Another important point in these symptoms were highlighted by Haadem et al (1987), where they noted half of the women in their study still had symptoms between 2 and 7 years after the injury. Brantley (1960) and Legino et al (1988) reported an incidence of rectovaginal fistula in patients with anal sphincter rupture involving anal mucosa of <1% and 1.5% respectively, while Goldaber et al (1993) found that 2 of 390 patients (0.5%) had rectovaginal fistula after the repair of fourth degree perineal tear, with total incidence of postpartum morbidity including infection and/or dehiscence of 5.4%.

It is understandable that most of these complications affect the mother psychologically as well as physically. Many women do not seek medical treatment for faecal incontinence because of embarrassment or because they are easily discouraged from discussing it. MacArthur et al (1997) noted that the most common reason for not consulting a doctor was that these women thought the symptoms would eventually improved, and/or that they hadn't had them long enough to go to the doctor. Other reasons given include 'it's not bad enough' or ' I can cope with it', embarrassment, all part of having a baby and the doctor can't do anything. In a study by Johanson (1996), only one third of the individuals with faecal incontinence had ever discussed the problem with a physician while Sultan (1994) reported 47% of the women with anal sphincter tear had defaecatory symptoms, but none had sought medical attention. Clinician does not enquire about defaecatory symptoms and when

women do complain to their general practitioner they are usually referred to general surgeons. It is therefore not surprising that many obstetricians are unaware of the true magnitude of the problem.

The understanding of normal anal sphincter anatomy, adequate assessment of the obstetric trauma and appropriate repair are the central to restoration of continence. During a median (midline) episiotomy the fibromuscular perineal body alone is divided. During postero-lateral episiotomy the superficial part of perineal body which includes the bulbospongiosus (previously known as the bulbocavernosus) muscle is first divided but as the incision is extended lateral to the anus the superficial transverse perineal muscle is then divided. As an episiotomy is usually performed when the head distends and stretches the perineum, the levator ani muscle is commonly not involved during an uncomplicated episiotomy, but if this does occur the most medial component of the levator ani muscle (puborectalis) would be cut. In advent extension of episiotomy, especially median variant would involve the external anal sphincter.

The muscle of the anal canal can be regarded as forming 'a tube within a funnel'. The sides of the upper part of the funnel are the levator ani muscles, and the stem of the funnel is the external anal sphincter, which is continuous with the levator ani. The tube inside the stem of the funnel is the internal sphincter, which is a thickened continuation of the inner circular layer of the rectal muscle. Internally lies the submucosa and mucous membrane.

The precise anatomy of the external anal sphincter has remained controversial. Considered by some to be a single muscle mass, others have subdivided it into two or three components, which are subcutaneous, superficial and deep portions, each composed of striated muscle. Endosonographic study by Sultan and co-workers (1994) did no revealed any plane of cleavage between the components of the external anal sphincter, though a changing pattern at different levels conforming to a trilaminar arrangement was apparent. The *subcutaneous* part of the external anal sphincter is a flat band, about 15 mm broad, which surrounds the lower part of the anal canal and lies horizontally below the lower border of the internal anal sphincter and of the superficial part of the external sphincter; it lies beneath the skin at the anal orifice and, centrally, it is subcutaneous below the white line in the canal. Anteriorly a few fibres are attached to the perineal body (or the superficial transverse perineal muscle), and posteriorly some fibres are usually attached to the anococcygeal ligament. The *superficial* part of the external anal sphincter is elliptical and lies deep to the subcutaneous part. It is the only part of the external sphincter that is attached to bone, arising from the posterior surface of the terminal segment of the coccyx by a median fibrous aponeurosis, the anococcygeal raphe; anteriorly, after surrounding the lower part of the internal sphincter, it is inserted chiefly into the perineal body. The *deep* part of the external sphincter is a thick annular band, which surrounds the upper part of the internal sphincter; its deeper fibres are fused with and inseparable from those of the puborectalis. In front of the anal canal many fibres of the anal canal many of the fibres of the deep part of the external sphincter decussate and become continuous with the superficial transverse perineal muscle, this arrangement being more marked in female. Posteriorly some fibres are usually attached to the

anococcygeal ligament. However, it has been asserted by some that there is no clear separation of the three parts of the external sphincter from each other. In female, the muscle is a single band, at least, in its anterior part. The external anal sphincter can be voluntarily contracted and thus more firmly occlude the anus. The nerve supply of the external sphincter is derived from the inferior rectal branch of the pudendal nerve (S 2 and 3) and from the perineal branch of the fourth sacral nerve (Williams 1980)

The internal anal sphincter is a thickening in the circular smooth muscle of the anal wall is under autonomic control and accounts for 80 percent of resting sphincter pressure (Madoff 1992). It may be 5-8 mm thick, but it does not occupy the whole length of the canal since the lowest part of the external sphincter comes to lie below its well-marked rounded lower border. The external and internal anal sphincter overlap by 17.0 mm, with the internal sphincter lying between external sphincter and anal mucosa. The internal anal sphincter extends an additional 12.2 mm cranial to the proximal extent of the external sphincter, whereas the caudal margin of the internal sphincter lies 3.7 mm cranial to the distal margin of the external sphincter (Delancey et al 1997).

Internal anal sphincter lies just inside the external anal sphincter and is separated from it by a visible intersphincteric groove. It can be identified as a rubbery white layer just beneath the anal submucosa in repair of a chronic laceration of the perineum involving the anal mucosa. The longitudinal layer of the bowel fuses with some fibrous elements of the puborectalis sling to form a thin fibroelastic sheet known as the *conjoint longitudinal coat*, which separates the external and internal anal sphincter. Strands from this sheet penetrate the internal sphincter and the lower

part of the external sphincter; some reach the fat of the ischiorectal fossa, the perianal skin or the mucous membrane of the intersphincteric groove.

The pudendal nerves are mixed nerves which carry both motor and sensory fibres. Initially the pudendal nerves lie superior to the sacrospinous ligament and lateral to the coccyx. Proximally, the pudendal nerve gives rise to a branch supplying the sphincter urethrae, which runs on the pelvic surface of the levator ani muscle complex. The nerve then leaves the pelvis by crossing the ischial spine to gain access to the ischiorectal fossa through the lesser sciatic foramen. From this point, it extends forwards in a fibrous tunnel, Alcock's canal, on the medial side of the obturator internus muscle. Distally the pudendal nerve divides into three branches which supply the levator ani complex, the external anal sphincter and terminally, the dorsal nerve of the clitoris.

When an individual feels the circumstances are appropriate, he or she voluntarily relaxes the external anal sphincter to allow defecation to proceed. Defecation is a complex behaviour involving both reflex and voluntary actions. The integrating centre for the reflex actions is the sacral spinal cord but is modulated by higher centres. The efferent pathways are cholinergic parasymphatetic fibres in the pelvic nerves. The symphatetic nervous system does not play a significant role in normal defecation.

Before defecation the smooth muscle layers of the descending colon and the sigmoid colon contract in a mass movement to force faeces toward the anus. The distension of

the rectum signals the urge to defecate, which is mediated primarily by the external nerves to the terminal end of the large intestine. The internal and external sphincters relax, the internal sphincter reflexly and the external sphincter voluntarily, and the lower part of the anal canal is opened out and flattened, so the mucous membrane of the upper part of the canal appears at the surface. The puborectalis muscle reflexly relaxes and allows alignment of the rectum and the anal canal.

Park et al (1977) showed an increase in fibrous connective tissue and degenerative changes in muscle fibres of the voluntary external anal sphincter in patients with anal incontinence. They suggested that incontinence occurred as a result of denervation by nerve injury associated with childbirth, or as a result of nerve entrapment or stretch injury of the pudendal nerve during repeated straining to defecate.

Further evidence for denervation and renervation in faecally incontinent women came from single-fibre electromyographic studies of the external anal sphincter, which showed neurons resprouting to reinnervate muscle fibres that had lost their nerve supply. A stimulating and recording electrode was developed to study the function of the pudendal nerve, which innervate the striated external anal sphincter muscle. Measurement of the pudendal nerve terminal motor latencies showed that patients with faecal incontinence had nerve latencies no longer than age-matched subjects, although some incontinent patients had latencies within normal range. Subsequent studies have shown that the smooth muscle of the internal anal sphincter is also affected by denervation.

Several studies have examined pelvic floor neurophysiological changes at childbirth and concluded that incontinence resulted from damage to the innervations of pelvic floor muscles, and not from direct muscle damage. Women who delivered vaginally develop increased single fibre density or concentric needle motor unit potential duration of their external anal sphincter, whereas there are no changes in women delivered by elective caesarean section (Kamm 1994).

Later on with the introduction of ano-endosonography, study on a consecutive series of women presenting with faecal incontinence, in whom the only apparent risk factor was obstetric damage, 90% were found to have a structural abnormality of one or both sphincters (Burnett 1991). In another study, Gjessing et al (1998) found sphincter defects by endosonogarphy in 75% of women with anal incontinence due to anal sphincter tear.

This unexpected findings cast doubt on the importance of neurological factors in the pathogenesis of the muscle weakness, and provided a mechanical explanation for dysfunction of muscles previously thought to be weak due to denervation. It also explained why some women with long nerve latencies and features of denervation were incontinent while others with the same neurological abnormalities were not. Sultan et al, in 1994 found that 85% of the women with anal sphincter tear had sonographic evidences of sphincter defect and all women with defaecatory symptoms had combined external and internal sphincter defects. But comparing these women with those without clinical evidence of sphincter tear, there was no significant difference in pudendal nerve terminal latency. It appears therefore that the severe

cases of obstetric trauma associated with abnormal anal function results from a combination of external and internal anal sphincter injuries while pudendal neuropathy may play a minor role. Zetterstrom et al (1999a) showed the clinically detected anal sphincter injury as the risk factor for postpartum anal incontinence in both univariate and multivariate analysis.

Yet pudendal nerve damage should not totally be disregard as seen in a study by Laurberg et al (1988). These researchers found that the result of surgical repair of anal sphincter tears was excellent or good in eight of ten patients in whom there was no evidence of nerve damage, while this was the case in only one of the nine patients with nerve damage detected with pudendal nerve terminal motor latency technique ($p= 0.018$).

The risk factors for OASI which have been identified include:

	Risk factor	Author	Year
1.	Nulliparity	Green Bek Combs Sultan Poen Wood	1989 1992 1990 1994 1997 1998
2.	Forceps delivery	Sultan Walsh Wood	1994 1996 1998

3.	Vacuum extraction	Sorensen Samuelsson	1988 2000
4.	Prolonged second stage	Poen Donelly Wood de Leeuw	1997 1998 1998 2001
5.	OP position	Sultan	1994
6.	Birth weight > 4 kg.	Green Sultan Wood	1989 1994 1998
7.	Epidural analgesia	Poen	1997
8.	Midline episiotomy	Green Kammerer-Doak Angioli Jander	1989 1999 2000 2001
9.	Oxytocin augmentation	Hadeem Samuelsson Jander	1988 2000 2001
10.	Age > 35 year	Jander	2001
11.	Asian race	Combs Handa	1990 2001
12.	Mediolateral episiotomy	Bek	1992
13.	Shoulder dystocia	Bek	1992
14.	Postmaturity	Zetterstrom	1999 (a)

The degree of anal incontinence can be measured by incontinence scoring systems or by quality of life assessment. Careful digital rectal examination may reveal some of

the anal sphincter defects. In a study by Nielsen at al (1992), seven of 13 patients in whom endosonographically confirmed to have anal sphincter defects, had them (defects) felt digitally.

The invention of anal endosonography allows imaging of anal sphincter muscles accurately and this has altered opinions not only about the pathogenesis of faecal incontinence, but also its investigation and management. The sonographic probe rotates through 120 or 360 degree sector inside a cone no larger than an examining finger, and provides a clear image of the internal and external anal sphincters. With this method, the extent of damage and degree of healing of the external and internal anal sphincter can be clearly seen. Defects in the external anal sphincter are seen as a break in the continuity of the normal texture of this muscle ring, and appear hypoechoic or amorphous. In contrast defects in the internal anal sphincter appear as a gap in the clearly identified homogenous hypoechoic ring.

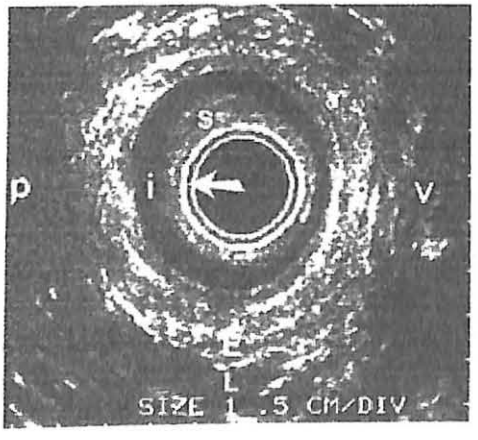

Fig 1 – cross sectional image of the mid anal canal in a nulliparous women. P= posterior; L= left; V= vagina; the bright ring (arrow) represents the reflections off the cone; s= submucosa; I= internal anal sphincter; E= external anal sphincter. Both sphincter rings are normal.

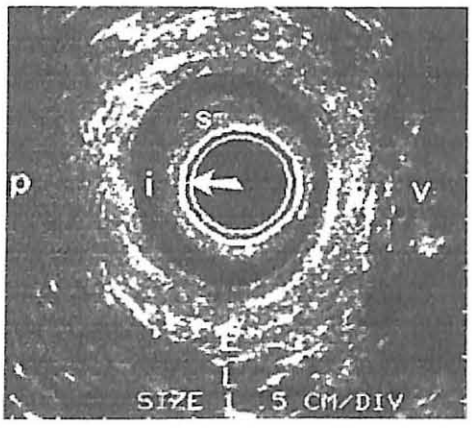

Fig 2- image of mid anal canal from a woman six months after a primary sphincter repair for a third degree tear. Arrows indicate an external sphincter defect. The hypoechoic internal anal sphincter (i) has also been damaged and is incomplete anteriorly.

Another technique, ano-rectal manometer, measures the pressure differences in the anal canal at rest and during straining. The method was described as using a catheter balloon with is introduced into the rectum and then gradually withdrawn until the anal high pressure zone was identified. The anal length is then measured from that point to the anal verge. Using interval station pull through technique, the maximum resting pressure was recorded. Most of the maximum resting pressure is contributed to the internal anal sphincter. The maximum voluntary contraction pressure is contributed to mainly by the striated external anal sphincter muscle and is determined by repeating a stationary pull through recording at the same intervals of 0.5 to 1.0 cm (Perry 1990) and is recorded as the incremental increase above the resting pressure. This indicates the physiological function of the anal sphincter during straining and relaxation, but it

does not identify the causative pathology either muscular or neurological, which underlies dysfunction.

Anal vector volume analysis was later design as conventional manometric techniques that measure average sphincter pressure cannot distinguish between traumatic and idiopathic incontinence. Perry at al (1990) have developed a technique of computerized vector manometry to identify anal sphincter injuries by the presence of manometric asymmetry in the anal canal. Here a catheter with eight side holes spaced at 45 degree intervals around the circumference was used. A station pull-out technique with 0.5 cm or 1.0 cm between stations allows 8 directional pressures could be detected at every half-centimetre interval. The computer then constructs a three dimensional anal pressure vectogram from the manometry data and rotates it on the screen to allow viewing from all directions. The mean vector symmetry index in asymptomatic women was 0.76, compared with 0.33 in incontinent women with a known sphincter injury. Nearly half of the women without any history of clinical anal sphincter injury had subnormal vector symmetry (less than 0.60), suggesting the presence of an occult sphincter injury. In another study by Fynes et al (2000), anal vector symmetry index, determined by analysis of mean maximum squeeze pressure, yielded 100 per cent sensitivity for significant external anal sphincter disruption, with a positive predictive value of 61 per cent.

Magnetic resonance imaging (MRI) of the pelvic floor was first described in the early 1980s. MRI permits recognition of the pelvic floor asymmetry, identification of

muscular defects and evaluation of the muscle volume. But in a study by Schafer and co-workers (1994) showed the current MRI assessment of the anal canal anatomy is elaborate, costly, and does not provide any further insight compared with anal ultrasound.

There are two recognized methods of for the repair of the damaged external sphincter, i.e. end-to-end or juxtaposition repair and overlap repair. Early approximation usually using the end-to-end repair method, the most popular method used in primary repair by the obstetricians, represents an attractive treatment option because it is relatively simple procedure and deals immediately with patient's injury. On the other hand, colorectal surgeons have tended to favour overlapping of the external anal sphincter muscle. This technique has been performed in an elective setting of either a delayed primary or secondary repair, when local bleeding and oedema have subsided, thereby facilitating a clearer view of the sphincter ends. In the end-to-end method, the torn ends of the external anal sphincter are brought together and sutured without any overlapping of the muscle, with interrupted or 'figure of 8' sutures. In the overlap method, the torn ends of the external anal sphincter are brought together and sutured by overlapping one end of the muscle over the other. Parks and McPartlin first described this technique in 1971, and its use in primary repair of an obstetric anal sphincter tear was reported by Sultan et al (1999).

Historically, primary repair of the obstetric anal sphincter injury after birth has been thought to yield good results but recent reports of the outcome after primary repair using the traditional end-to-end approximation showed poor results. Haadem et al

(1987) documented that half of the women who had anal sphincter rupture during vaginal delivery still suffer significant trouble, such as incontinence for gas, dyspareunia, and pain, 2 to 7 years after primary repair using end-to-end approximation. In another study on 35 patients who suffered OASI and repaired primarily with same technique, follow up for up to 69 months were done. Fifty seven percent of these women reported anal incontinence symptoms: 12 incontinent of flatus, 4 were incontinent of liquid stool and 4 of solid stool. Most commonly symptoms were recognised shortly after delivery, but in two women incontinence symptoms appeared 6 months after delivery (Gjessing 1998). Similar results were also reported by Sultan et al (1994), where they found 47% of the women who had OASI repaired with end-to-end approximation had defaecatory symptoms and 85% showed sonographic evidences of sphincter defect. These results suggest the primary end-to-end approximation is unsatisfactory.

Secondary repair by colorectal surgeons using overlap method showed restoration of continence in up to 76% of patients. Study by Sultan et al (1999) on this method, used in primary repair of OASI showed favourable outcome. The first reported prospective, randomised, controlled trial comparing the above two techniques of repair in primiparous subjects showed the result after the primary repair was similar in objective or subjective outcome (Fitzpatrick 2000). In this study 55 women underwent an overlap repair, and 57 underwent an approximation procedure. The results gathered at 3 months postpartum showed 20% complained of faecal urgency after overlap repair, in comparison with 30% after approximation repair, which is statistically not significant. No significant differences were observed in term of anal

manometric study and endoanal sonography (69% showed visible defect of external anal sphincter after overlap repair and 75% after approximation repair).

The above data are the results showed improvement in majority of the patients in short term. But in long term, the results of overlapping sphincter repair for obstetric anal sphincter damage seem to deteriorate with time. This was shown in a study in patients who had had repair a minimum of 5 years. Of 38 assessed patients, none was fully continent to both stool and flatus although many of them had previously been shown by endosonography to have a good overlap repair, who had good squeeze pressure, and had initial improvement in symptoms (Malouf 2000).

There are other issues concerning anal sphincter tear that are not been clear. Who should do the repair, the obstetrics team or the colorectal surgeon; timing of the repair, immediately or secondary repair; what suture material to use, absorbable, delayed absorbable or non absorbable, the associated post operative care, the antibiotic and the laxatives; follow up interval; the investigation to use and finally the plan for the after-coming pregnancy.

MATERIALS AND METHODS

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Participants are all cases of singleton vaginal delivery complicated by OASI (anal sphincter tear with or without involvement of anal mucosa) from January 1996 to December 2000 were identified through the Labour Ward registration record book and data were obtained from the medical record from HUSM Record Office.

Fifty two cases were identified throughout the destined period of study. All tears were identified and repaired by the attending senior obstetric medical officer or registrar in-charged of labour room. Demographic data such as age, parity and ethnicity were gathered. Study parameters identified were the gestational age in weeks, duration of first and second stage of labour; in minutes, type of delivery (spontaneous, ventouse extraction or forceps delivery), presence of episiotomy, fetal presentation during the delivery (cephalic or breech), analgesia(s) used during labour; no analgesia, Pethidine, epidural anaesthesia, augmentation of labour with oxytocic drug, birth weight of the baby, past history of instrumental delivery and analgesia used to repair the external sphincter tear. Forceps used in our centre were of Wrigleys and Neville-Barnes design. The vacuum cup used were Malstrom and anterior Bird design, 5 cm in diameter and Silc cup sized 5 and 6 cm. Gestational age of at least 37 weeks, determined from the last normal menstrual period or early first trimester ultrasonogarphy was used as an inclusion criterion for both cases and control. All episiotomy are of mediolateral type. Patients excluded are the preterm or postterm pregnancy and multiple pregnancy.

To control for changes over time (e.g. in health care and health personnel), a systematic random sample of six cases per case identified (three vaginal deliveries prior to and following) giving the total of 312 patients used as control group. Control samples were those with intact perineum, episiotomy without extension and first or second degree perineal tear.

Tables of categorical data were analysed using the Pearson's $X2$ statistic. The association between the above factors and the occurrence of OASI was tested in univariate logistic regression. Stepwise logistic regression analysis was used to suggest the predictor variables, which consisted of apparently independent and significant predictors of sphincter tear. Odd ratios with 95% confidence intervals, which is an estimate of the relative risk, were calculated. The odds ratio for each explanatory variable is expressed relative to a fixed reference level for that variable. Using parity as an example, the odds ratio is expressed as that for nulliparous women relative to multiparous women and in mode of delivery, spontaneous vaginal delivery. For each explanatory variable, we calculated the univariate (uncorrected) odds ratio. Then all these factors were processed by stepwise logistic regression analysis with comparison to other possible confounding factors. A statistically significant predictor is one for which the 95% confidence limits lie entirely above or below unity. We performed statistical analysis using Epi Info version 6 and Statistical Package for Social Science (SPSS) version 9.0 for Windows programs.

RESULTS

AND

ANALYSIS OF DATA

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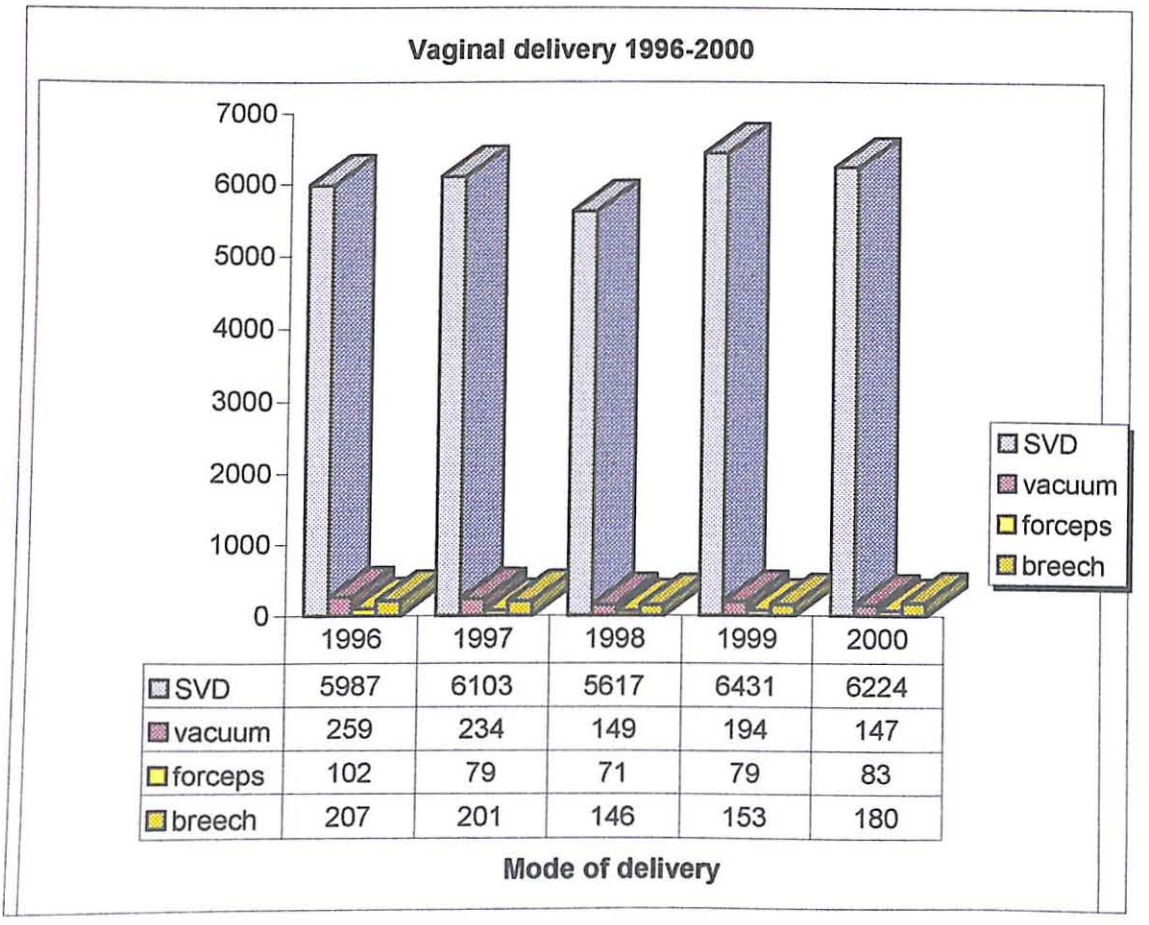
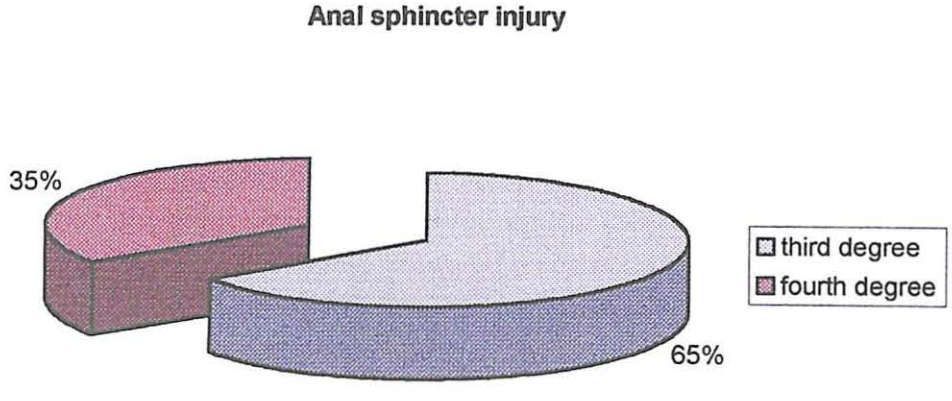
Chart 1: Distribution of vaginal delivery in HUSM, 1996- 2000.



	1996	1997	1998	1999	2000
SVD	5987	6103	5617	6431	6224
vacuum	259	234	149	194	147
forceps	102	79	71	79	83
breech	207	201	146	153	180

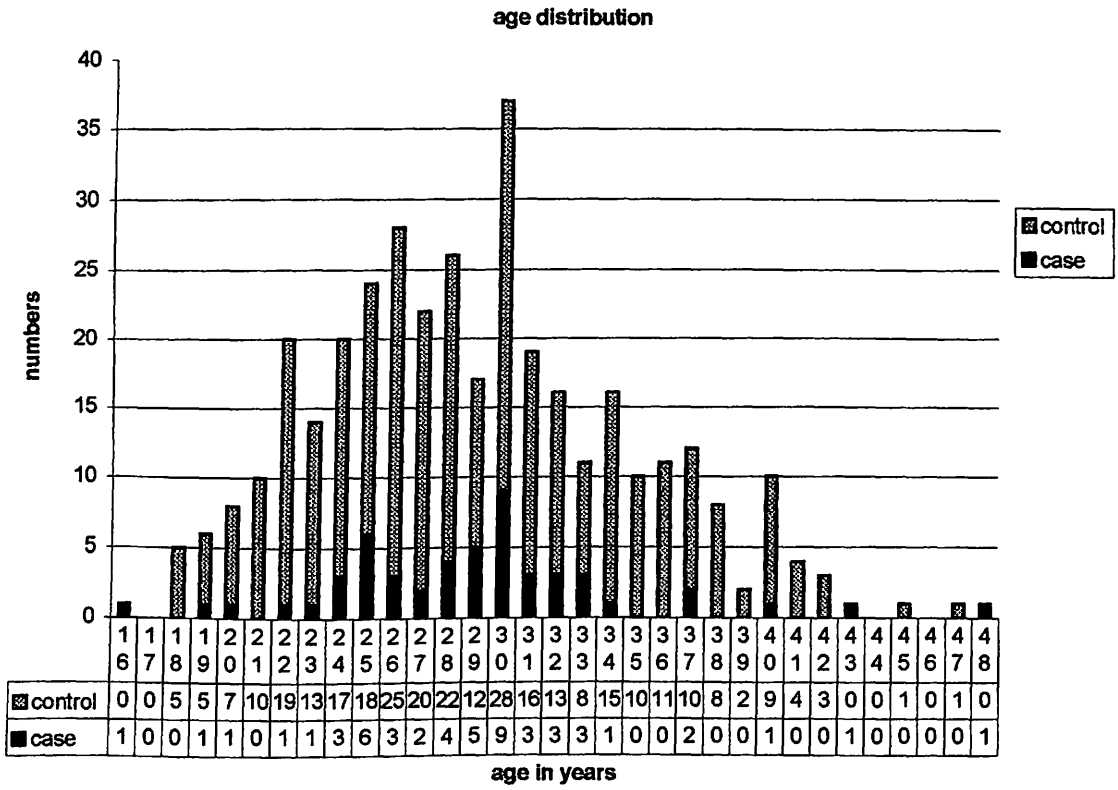
There were a total of 32,831 vaginal deliveries from 1st of January 1996 to 31st December 2000. Three percent of the vaginal deliveries were associated with vacuum extraction and forceps delivery accounted for 1.26 percent. Vaginal breech delivery rate during this 5 years period was 1.4 percent.

Chart 2: Degree of anal sphincter injury



Total of 52 cases of obstetric anal sphincter injury were recorded giving the incidence of OASI of 0.16%, with 35% were associated with anal mucosa tear while 65% were anal sphincter tear alone (without anal mucosa involvement).

Chart 3: Age distribution in case and control groups.



	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
control	0	0	5	5	7	10	19	13	17	18	25	20	22	12	28	16	13	8	15	10	11	10	8	2	9	4	3	0	0	1	0	1	0
case	1	0	0	1	1	0	1	1	3	6	3	2	4	5	9	3	3	3	1	0	0	2	0	0	1	0	0	1	0	0	0	0	1

The chart above shows the distribution of the sample in term of the age (in years), where there was no difference noted (as the analysis below)

Table 1- Age distribution.

	Mean	Mod	Minimum	Maximum	SD
Case	29.00	30	16	48	5.55
Control	28.94	30	18	47	5.84

P =0.66 (95% CI –1.65- 1.77).

The mean age in the OASI group was 29 years while the mean age group in the control group was 28.94, and this in not significantly different. The youngest mother delivered during the study period in the OASI and control group were 16 and 18 respectively. The maximum age recorded was 48 in the OASI group and 47 years old in the control group.